

# AUXILIARY ALARM CLOCK SYSTEM FOR A PERSONAL COMPUTER

The present invention claims priority to Provisional Application Serial No. 60/475,887, filed June 4, 2003.

## 1. Field of the Invention

The present invention relates to enhancements for personal computers, and more particularly, to an alarm clock for a personal computer that is operable when main system power is on or off.

## 2. Background of the Invention

Conventional PC systems may include a hardware/software built-in alarm clock system using the Real Time Clock (RTC). The RTC is controlled by the OS. The latest Operating Systems (e.g. Microsoft Windows®) allow the user to setup up a wakeup interrupt from the RTC alarm to power on the system. However, this approach requires a very complicated design. For example, a separated power plane on the system board is required to allow the chipset to receive the RTC wakeup interrupt signal when the rest of the system is powered off. On the other hand, to setup the clock requires the complete system boot up process and use the complicated Operating System to do a simple setup. Also, there is no indicator on the system to tell the current time or that the alarm is turned on.

## Summary of the Invention

The present invention provides a system and method to provide a cost effective and user friendly alarm clock solution. One exemplary implementation of the present invention is an IC that provides a simple and easy to use alarm clock function for the PC system. The IC of the present invention is operable when the system is turned off, and

1 therefore does not require the PC system to be on to function properly. An interface may  
2 be provided, such as a LCD/LED/VFD or other display module interfaces, to provide  
3 complete user control over the IC when PC power is off. The IC may be implemented  
4 using a dual clock switch (host system clock and auxiliary clock) to allow the IC to work  
5 at different speed for different operation modes (PC system on/off). The IC also provides  
6 a control interface to that is adapted to generate control signals to control the operation of  
7 an optional internal AM/FM radio circuit, an external AM/FM radio circuit and/or other  
8 circuits such as a TV board associated with PC system that permits viewing of TV on the  
9 PC. The AM/FM circuit and/or TV board are only exemplary alarm functions that can be  
10 selected by the present invention, and the present invention is intended to be of broad  
11 scope in that any alarm function can be selected (for example, powering ON the  
12 computer system, loading a software program and generating an alarm tone through the  
13 audio system of the computer system). The IC may include non-volatile memory to  
14 permit the IC to auto configure and functional without the system bus interface. The IC  
15 can be implemented in many different approaches such as state machines or  
16 microprocessor based design.

17 In one aspect the present invention provides an alarm clock IC adapted for use in  
18 a personal computer (PC). The IC includes alarm clock logic circuitry adapted to receive  
19 a signal indicative of the power status of the PC and further adapted to generate an alarm  
20 clock event at a preselected time.

21 In another aspect the present invention provides an alarm clock PC system. The  
22 system includes a PC adapted to generate a signal indicative of the power status of the

1 PC, and an alarm clock IC adapted to receive the signal indicative of the power status of  
2 the PC and further adapted to generate an alarm clock event at a preselected time.

3 In method form, the present invention provides a method of operating a PC as an  
4 alarm clock that includes the steps of monitoring the power status of the PC and  
5 generating an alarm clock event at a preselected time.

6 It will be appreciated by those skilled in the art that although the following  
7 Detailed Description will proceed with reference being made to preferred embodiments  
8 and methods of use, the present invention is not intended to be limited to these preferred  
9 embodiments and methods of use. Rather, the present invention is of broad scope and is  
10 intended to be limited as only set forth in the accompanying claims.

11 Other features and advantages of the present invention will become apparent as  
12 the following Detailed Description proceeds, and upon reference to the Drawings,  
13 wherein like numerals depict like parts, and wherein:

#### 14 Brief Description of the Drawings

15 Figure 1 is a block diagram of the alarm clock IC of the present invention.

#### 16 Detailed Description of Exemplary Embodiments

17 Figure 1 depicts a block diagram of the alarm clock IC 10 according to the present  
18 invention. The IC 10 may include one or more of the following modular components.

19 1) Host Interface 12. The host interface provides a bus interface between the IC  
20 10 and the PC system (e.g., PCI bus, SMBus, etc) and allows the PC system to control  
21 and access the IC 10. The interface 12 can be LPC (Low Pin Count), USB, SMB or any  
22 other system bus interface.

1           2) Power Control interface 14. The power control interface 14 is provided to  
2 control the PC system power. The Power Good signal can be an input into the IC, and  
3 may be used to indicate whether power is applied to the system bus or the PC system.  
4 Essentially, the power good signal is a signal indicative of the power status of the PC  
5 system (not shown).

6           3) User Input interface 16 provides user control over some basic functions of the  
7 IC such as alarm clock settings without the requiring the PC system Operating System.  
8 The interface 16 may be implemented as input buttons or a remote control transceiver  
9 module. An RF or IR remote control (not shown) may also be used with this interface.

10          4) Display module interface 18 provides a display interface for the end user to  
11 display the status of the IC, such as alarm is turned on. This generic interface can support  
12 both serial and parallel LCD, LED, VFD or other display module or driver.

13          5) AM/FM Radio Module interface 20 may be provided to send control signal to  
14 an AM/FM radio module associated with the PC system or the user input interface 16  
15 when the PC system is powered off.

16          6) Auxiliary Clock interface 22. This clock interface provides the clock signal for  
17 the IC when the host interface 12 cannot provide the clock signal, i.e., when the PC  
18 system power is off. The auxiliary clock can be generated by a clock input or built-in  
19 internal clock oscillator.

20          7) Non-volatile memory interface 24. Non-volatile memory, which is accessible  
21 by 24, may be provided to generate initialization information for the IC if power is  
22 applied to the IC without the PC system power. If the IC includes the internal memory  
23 24, external memory may not be required.

1           8) Alarm Clock Logic 26 provides the commands for the IC to function as an  
2 alarm clock.

3           9) Dual Power Inputs. In the exemplary embodiment, the IC 10 is adapted to  
4 accept two power inputs: a host interface power input and an IC power input. The host  
5 interface power is separated from the other portions of the IC. This permits, for  
6 example, the IC to continue to be functional with minimal power consumption when the  
7 PC system power is turned off. The Power Good input signal may be used to indicate  
8 when the system power is removed.

9   System is ON:

10           When the PC system is turned on, the system can use the host interface 12 to  
11 receive commands from the input buttons or remote control receiver inputs, via the user  
12 input interface 16. An application program may be provided in the PC system to decode  
13 and send the user inputs to the Operating System (e.g., Windows operating system). For  
14 example, the user can use the buttons to control the AM/FM radio channel, as generated  
15 by the control signal from the AM/FM interface 20 to the AM/FM radio module. The  
16 application program may also be adapted to automatically adjust the time inside the IC  
17 alarm clock logic 26 to match with the system RTC. The application program may also  
18 accept traditional keyboard or mouse input devices to setup the IC. The setup  
19 information can be stored in the internal or external non-volatile memory so that the IC  
20 can be functional without the system host, even when the power has been removed from  
21 the IC.

22   System Power Control:

1           The user can use the input buttons or remote controller to turn off the system  
2 power. When the system receive the system power down requests, the system can send  
3 the command back to the IC which will use the power control interface to turn off the  
4 system power. If there is another power switch input on the system, it can be connected to  
5 the IC to eliminate the system board design change for multiple power switch controls.

6   System is OFF:

7           The Power Good is used to indicate the host system power is removed. The IC  
8 will continue to be functional with the IC power input. If the system power is off, the  
9 clock input is switched to the auxiliary clock input. Preferably, the auxiliary clock can be  
10 slowed to save power consumed by the IC. Since the system has a slow clock (e.g.,  
11 32.768Khz) for the RTC, it can be connected to the IC. In this case, the IC would be  
12 running at clock rate of the RTC. This may help eliminate the time discrepancy problem  
13 due to different clock inputs between the IC 10 and system clock.

14          When the PC system is off, the user may also use the IC user input interface to  
15 setup the alarm clock or turn on the AM/FM radio. The display module interface is  
16 adapted to control an LCD, LED, VFD or other display to provide the information of the  
17 user inputs and the setting information. The setting can be stored in the internal or  
18 external non-volatile memory 24.

19          When the PC system power is off, the non-volatile memory interface 24 will  
20 automatically load the initialization information into the IC to perform a predefined  
21 setup. This may eliminate most or all manual setup after a power failure which results in  
22 total power loss.

23   Alarm Clock Logic:

1           When the alarm time is reached, the IC can automatically turn on the AM/FM  
2 radio associated with the PC system. The radio interface 20 generates the appropriate  
3 commands and data to the external radio module. Alternatively, the alarm clock logic  
4 can be adapted to turn the PC system on. If the system is turned on, an application  
5 program can also detect the alarm setting of the IC and invoke other application programs  
6 such as turning on the TV tuner inside the system. The application program may turn on  
7 the AM/FM radio external circuitry if it is not connected to the IC directly.

8           The alarm clock function can also provide Sleep Power Down function. For  
9 example, the computer system may be turned on for TV function. The alarm clock logic  
10 may be adapted to send out an interrupt (through the host interface) or power down signal  
11 (through the power control interface) to the system when the sleep timer reaches the time  
12 to turn off the system power automatically. To further reduce the power consumption,  
13 the AM/FM radio module may be powered down by the IC when it is not required (not  
14 shown in the block diagram).

15           As described above, numerous alarm clock events can occur using the alarm clock  
16 logic of the present invention. For example, some exemplary alarm clock events  
17 described herein include controlling an internal or external AM/FM radio module, TV  
18 module, powering up the system to launch an application, powering down the system,  
19 and/or other event. It should be understood that those skilled in the art will recognize  
20 numerous modifications to the specific alarm clock events described herein, and all such  
21 modifications are deemed within the broad concepts of the present invention. Therefore,  
22 the term “alarm clock events” shall be construed broadly to mean any event that trigger a  
23 multimedia component of the IC and/or PC system, or powering ON or OFF the PC

1 system, at a user-specified or preprogrammed (i.e. preselected) time. Multimedia  
2 components include, for example, AM/FM radio modules, TV modules, DVD play  
3 applications, CD-ROM or audio music play applications, or other components that  
4 generate video or sound. Likewise, the alarm clock logic 26 described herein shall also  
5 be construed broadly as circuitry adapted to generate one or more “alarm clock events”.

6 As should be evident from the exemplary embodiments described herein, the  
7 alarm clock IC of the present invention is adapted to monitor the power status of the PC  
8 and generate an alarm clock event based upon

9 Those skilled in the art will recognize that the IC 10 of the present invention  
10 combines several modular components to accomplish the stated functionality. The IC 10  
11 and one or more of the modular components can be constructed out of conventional  
12 and/or custom circuitry and/or state machine circuits without departing from the scope of  
13 the present invention. Additionally, the present invention describes application programs  
14 (run on the PC system) to accomplish some functionality associated with control or  
15 operation of the alarm clock IC 10. Those skilled in the art will recognize that such  
16 application programs can be formed of conventional and/or proprietary programming and  
17 source code to perform the stated functionality, all of which should be readily apparent to  
18 those skilled in the art and which are deemed within the spirit and scope of the present  
19 invention. A PC system may be adapted with the IC 10 described herein, and such PC  
20 system may include a laptop or desktop PC.